

TRAUMATIC BRAIN INJURIES IN MASSACHUSETTS: DATA SUMMARY

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The Public Health Importance of Traumatic Brain Injury (TBI):

Traumatic brain injury is an injury to the head arising from blunt or penetrating trauma or from acceleration-deceleration forces that is associated with any of these symptoms or signs attributable to the injury: decreased level of consciousness, amnesia, other neurologic or neuropsychologic abnormalities, skull fracture, diagnosed intracranial lesions, or death.¹

Each year the number of traumatic brain injuries occurring in the United States is 8 times higher than the number of people diagnosed with breast cancer and 34 times the number of new cases of HIV/AIDS.²

Each year in the United States, about 1.4 million people sustain a traumatic brain injury. Approximately 50,000 die, 235,000 are hospitalized and 1.1 million are treated and released from an emergency department.³ Total lifetime costs associated with TBI injuries that occurred in 2000 are conservatively estimated at \$60 billion.⁴ These costs do not take into account undiagnosed TBIs or those treated at a health care center or physicians office.⁴

The majority of individuals who sustain a moderate or severe TBI experience significant physical, behavioral/psychiatric, psychosocial, cognitive, and medical problems.⁵ These health problems negatively impact functional independence, community access and living skills, vocational outcomes, and psychosocial development, which may extend throughout a lifetime. Research has shown that TBI can contribute to an increase in high school dropout rates, unemployment, risk for substance abuse, psychiatric hospitalizations including suicide attempts, and criminal activity.⁵

For information on data sources and methodology used in this bulletin please refer to Data Sources and Method Notes on page 7.

Recent Massachusetts TBI Statistics: 2004 Deaths, and FY2004 Inpatient Hospitalizations, Observation Stays, and Emergency Department (ED) Visits for Non-fatal TBI's

Magnitude:

- In 2004, there were 486 TBI-related deaths among MA residents. TBI was associated with 19% of all injury deaths.
- In FY 2004, there were 4,994 inpatient hospitalizations, 1,226 observation stays and 37,298 emergency department (ED) discharges associated with a nonfatal TBI among MA residents.
- 34.1% of TBI-related inpatient hospitalizations had a diagnostic code of intracranial injury or hemorrhage, and 20.3% had a diagnostic code of skull fracture or fractures.

Predictable - Preventable

Most traumatic brain injuries are preventable. Because the sequence of events leading up to these injuries frequently follow a predictable pattern, points for intervention are possible. Prevention of these injuries often requires a multi-faceted approach involving education, enactment and enforcement of laws, and modifications in the environment where injuries occur.

- 35.8% of TBI-related inpatient hospitalizations were discharged to a skilled nursing care facility, rehabilitation, or other health care institution.

Leading Cause and Intent of TBI:

- The leading cause of TBI-related deaths, inpatient hospitalizations, observation stays, and ED visits is a fall (representing 38.3%, 53.7%, 40.7%, and 42.9% of all cases, respectively).
- Most TBIs are unintentional (“accidentally inflicted”). Among 2004 TBI-related deaths, 68.1% were unintentional, 16.5% were suicides, and 9.1% were homicides. Among 2004 TBI-related inpatient hospitalizations, observation stays, and emergency department visits, 89.2% were unintentional and 8.8% were due to an assault.

Age, Sex, and Racial/Ethnic Groups with the Highest Rates of TBI:

- TBI-related death and inpatient hospitalization rates are highest among individuals 85 years and older (60.2 and 506.2 per 100,000, respectively). TBI-related observation stay and ED visit rates are highest among infants less than 1 year of age (102.2 and 1,675.8 per 100,000, respectively).
- Males have higher rates of TBI-related death, inpatient hospitalizations, observation stays, and ED visits, compared with females (rates of 10.7 vs. 4.7, 94.0 vs. 62.6, 25.3 vs. 13.3, and 666.2 vs. 501.4 per 100,000, respectively).
- Age-adjusted TBI-related death rates were highest among White non-Hispanic residents (7.1 per 100,000 compared with 6.7, 3.6, and 3.0 per 100,000 among Black non-Hispanic, Hispanic, and Asian, non-Hispanic residents, respectively).

Total Acute Care Hospital Charges for TBI-Related Discharges:

- Total acute-care charges for TBI-related inpatient hospitalizations, observation stays, and emergency department visits exceeded \$257 million in FY2004. The average charge per inpatient hospitalization was \$30,777. Among inpatient hospital discharges, 49.7% of charges were paid through public sources. Among observation stays 35.8% were paid through public sources, and for ED visits, 31.9%.

Table 1. Summary of Massachusetts TBI Data

	Deaths, 2004			Non-fatal Hospital Discharges ¹ FY2004			Non-fatal Observation Stays ¹ FY2004			Non-fatal ED Visits ¹ FY2004		
		Count	Rate*		Count	Rate*		Count	Rate*		Count	Rate*
Total TBI		486	7.6		4,994	77.8		1,226	19.1		37,298	581.3
Highest Rates:												
Sex	Male	331	10.7	Male	2,921	94.0	Male	786	25.3	Male	20,696	666.2
Race/Ethnicity	White, Non-Hispanic	426	7.1	Black	274	80.8	Black	120	31.1	Black	2,662	694.3
Age Group	85+ years	82	60.2	85+ years	689	506.2	<1 year	82	102.2	< 1 year	1,344	1675.8
		Count	Percent		Count	Percent		Count	Percent		Count	Percent
Leading Causes:	Fall	186	38%	Fall	2,683	54%	Fall	499	41%	Fall	15,999	43%
	Firearm	111	23%	MV Occupant ²	1,056	21%	MV Occupant ²	265	22%	Struck by/against	9,543	26%
	MV Occupant ²	91	19%	Struck by/against	354	7%	Struck by/against	167	14%	MV Occupant ²	6,431	17%

¹ Fiscal year (October 1, 2003 – September 30, 2004).

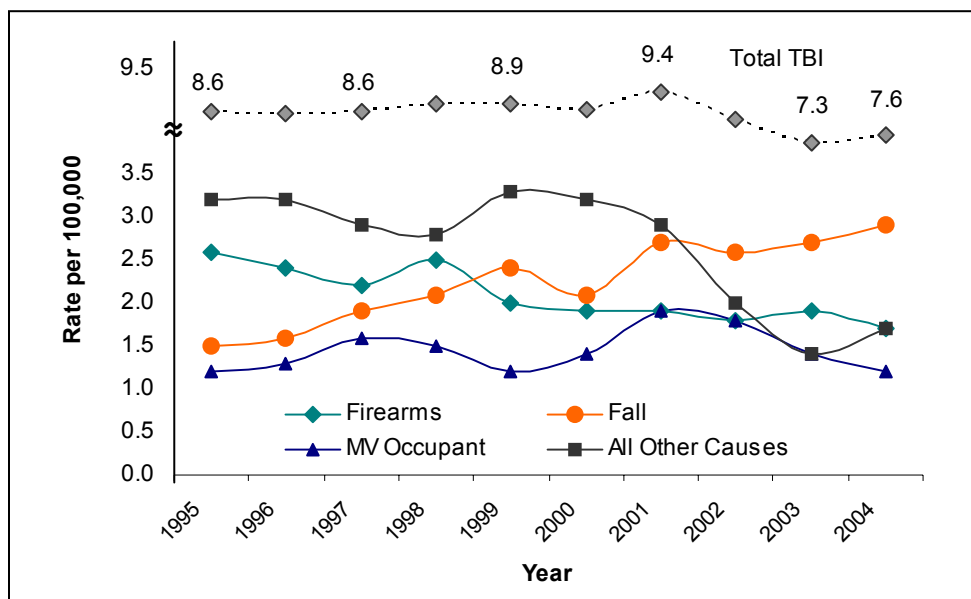
² Motor vehicle occupant includes occupants, motorcyclists, and unspecified persons injured in a motor vehicle traffic related crash.

*Per 100,000 residents.

Trends in TBI-related Deaths:

The number of TBI deaths among Massachusetts residents remained relatively stable from 1995 to 2002 (N=527 and N=530 respectively), and decreased slightly in 2003 and 2004 (N=471 and N=486, respectively). However, while TBI death rates for certain causes (e.g., firearms) have declined, others such as fall-related TBI deaths have increased (see Figure 1).

Figure 1. TBI Death Rates by Cause per 100,000 MA Residents, 1995-2004

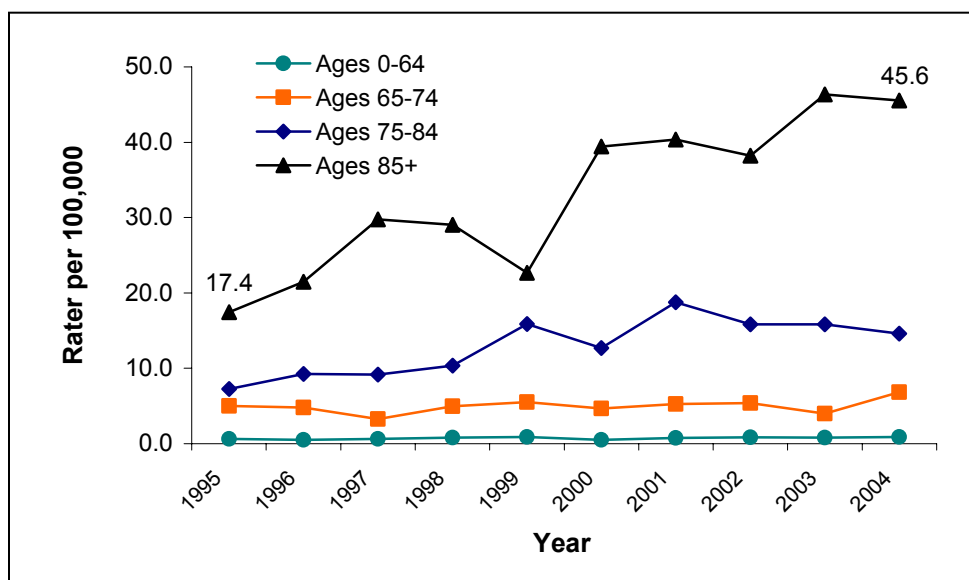


Source: Registry of Vital Records and Statistics, MDPH. Note break in Y axis to accommodate findings in graph.

From 1995 to 2004:

- The rate of firearm-related TBI deaths decreased 34.6% (2.6 per 100,000, N=158 and 1.7 per 100,000, N=111, respectively).
- The rate of fall-related TBI deaths increased 93.3% (1.5 per 100,000, N=95 and 2.9 per 100,000, N=186, respectively). This increase was due to the number of persons ages 75 and older who died as a result of a fall-related TBI.
- The rate of motor-vehicle occupant TBI deaths increased 7.7% (1.3 per 100,000, N=77, and 1.4 per 100,000, N=91, respectively).
- The number of TBI deaths in “all other causes” declined sharply from 2001 to 2004. This decrease was primarily due to a reduction in the number of death certificates with “unspecified cause” codes assigned.

Figure 2. Fall-related TBI Death Rates by Age Group per 100,000 MA Residents, 1995-2004



Source: Registry of Vital Records and Statistics, MDPH

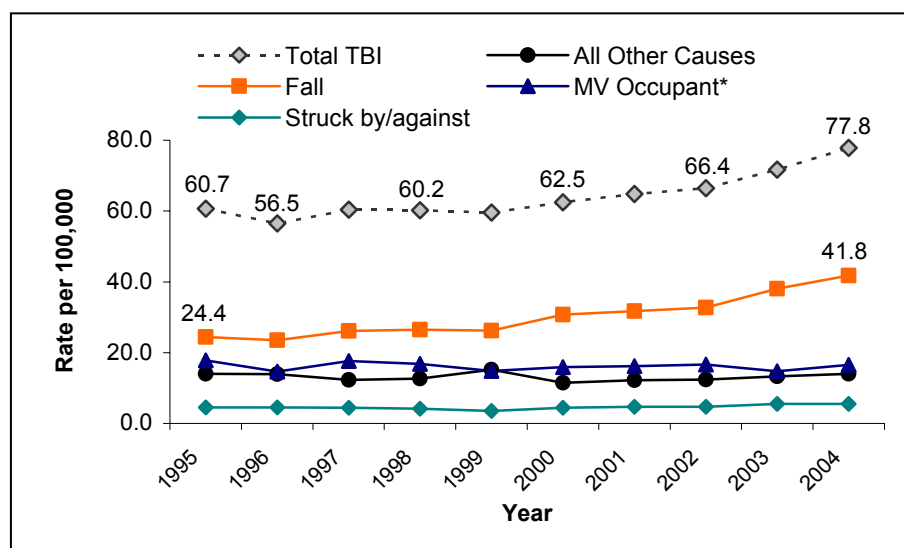
From 1995 to 2004:

- Persons with the highest rates of fall-related TBI deaths were those between the ages of 75 and 84 years, and those 85 years and older.
 - Among persons ages 75 to 84, fall-related TBI death rates increased 101% from 1995 (7.3 per 100,000, N=20) to 2004 (14.6 per 100,000, N=47).
 - Among persons ages 85 years and older, fall-related TBI death rates increased by 161% between 1995 (17.4 per 100,000, N=19) and 2004 (45.6 per 100,000, N=62).

Trends in Nonfatal TBI:

The rate of hospitalizations for nonfatal TBI in Massachusetts increased 28.2% from 60.7 per 100,000 in 1995 to 77.8 per 100,000 in 2004 (N=3,728 and 4,994 respectively).

Figure 3. TBI Hospitalization Rates per 100,000, MA Residents, 1995-2004

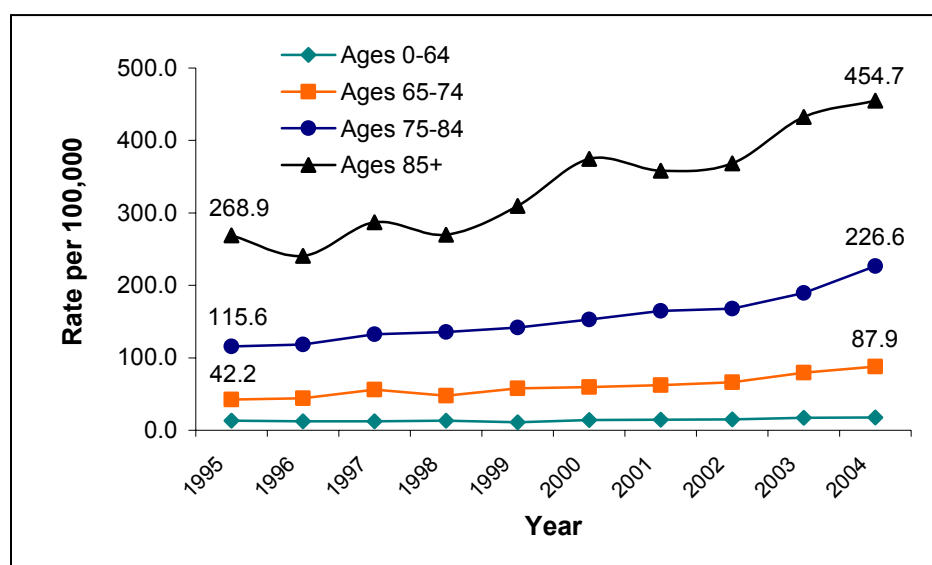


Source: MA Inpatient Hospital Discharge Database, MA Division of Health Care Finance and Policy.

From 1995 to 2004:

- The increase in TBI-related inpatient hospitalizations is primarily due to an increase in fall-related TBIs.
- The rate of inpatient hospitalizations for fall-related TBI increased 71.3% from 1995 (24.4 per 100,000, N=1,500) to 2004 (41.8 per 100,000, N=2,683).
- Rates among other leading causes of TBI-related inpatient hospitalizations (e.g., motor vehicle traffic related TBIs) remained relatively stable over the ten year period.

Figure 4. Fall-related TBI Hospitalization Rates by Age Group per 100,000 MA Residents, 1995-2004



Source: MA Inpatient Hospital Discharge Database, MA Division of Health Care Finance and Policy.

From 1995 to 2004:

- The rate of inpatient hospitalizations for fall-related TBI among persons 65 years and older increased 79% (134.4 per 100,000, N=1,110 and 240.6 per 100,000, N=2,056, respectively).
- Fall-related TBI inpatient hospitalization rates among MA residents increased 93% from 21.7 per 100,000 in 1995 to 41.8 per 100,000 in 2004.
- Persons ages 85 years and older had the highest rates overall with a 69% increase from 1995 to 2004 (268.8 per 100,000 and 454.7 per 100,000, respectively).
- Persons ages 65 to 74 had the largest increase (108%) during this time period; from 42.2 per 100,000 in 1995 to 87.8 per 100,000 in 2004.
- The reasons for these increases are not well understood. A close examination of a sample of records may improve our understanding.

Work-related TBI in MA

Table 2. Summary of Massachusetts Work-related TBI

	Non-fatal Hospital Discharges ¹			Non-fatal ED Visits ¹		
	FY2004			FY2004		
		Count	Rate ³		Count	Rate ³
Work-related TBI Injuries ²		122	3.8		1,778	54.9
Highest Rate:						
Sex	Male	104	6.2	Male	1,181	70.7
Race/Ethnicity	Hispanic	14	6.5	Black	125	78.8
Age Group	65-74 years	7	7.3	20-24 years	244	84.5
		Count	Percent		Count	Percent
Leading Causes:	Fall	66	54%	Struck by/against	859	48%
	MV Occupant ⁴	21	17%	Fall	598	34%
	Struck by/against	17	14%	MV Occupant ⁴	122	7%

¹ Fiscal year (October 1, 2003 – Sept. 30, 2004).

² Work-related injuries have an expected payer of Worker's Compensation.

³ Rates are annual averages, expressed per 100,000 workers and are calculated using MA workforce estimates from the Current Population Survey.

⁴ Includes drivers, riders, passengers, and others injured in a motor vehicle crash (excludes pedestrians struck by a motor vehicle).

In 2004:

- In 2004, there were 122 inpatient hospitalizations and 1,778 emergency department (ED) visits associated with a nonfatal TBI that occurred at work.
- Male workers had higher rates of inpatient hospitalizations and ED visits than female workers.
- TBI-related hospitalization rates were highest among workers ages 65-74 years but total numbers were highest among those between the ages of 25 and 34 years (N=33).
- TBI-related ED visit rates were highest among workers ages 20-24 years old (84.5 per 100,000 workers compared with 61.6, 53.0, 44.2 and 49.3 per 100,000 among the 25-34 year olds, 35-44 year olds, 45-54 year olds, and 55-64 year olds, respectively).
- The leading cause of work-related TBI inpatient hospitalizations and ED visits were falls and struck by/against, respectively.

Comparison to National Data and Benchmarks:

	United States 2001			Massachusetts 2004		
	Number	Crude Rate/ 100,000	Age-adjusted Rate/100,000	Number	Crude Rate/ 100,000	Age-adjusted Rate/100,000
Deaths	50,498	17.7	17.7	486	7.6	7.7
Nonfatal Inpatient Hospitalizations	243,000	85.2	85.3	4,994	77.8	69.2
U.S. Healthy People 2010 Benchmark ⁶	--	--	45.0	--	--	--
Nonfatal Observation Stays*	--	--	--	1,226	19.1	19.2
Nonfatal ED Visits	1,181,000	414.0	415.6	37,298	559.8	572.3
Total	1,475,000	--	--	44,004	--	--

U.S. Data Source: Centers for Disease Control and Prevention, Unpublished data, 2004.

U.S. hospitalizations, ED visits, and Total are rounded to the nearest thousand. Total may not add to sum due to rounding.

2004 U.S. Census MA population estimates were used to calculate the MA rates.

*Massachusetts distinguishes between inpatient hospital admissions and "observation stays". Data are collected in two distinct and mutually exclusive databases. The U.S. hospitalization number may include such cases in their overall hospitalization count.

Massachusetts compares favorably to the U.S. for TBI deaths (7.7/100,000 and 17.7/100,000 respectively). The age-adjusted rate, however, for TBI-related ED visits are higher for Massachusetts than the U.S. and the TBI-related hospitalization rate among Massachusetts residents (69.2/100,000) is noticeably higher than the Healthy People 2010 benchmark of 45 per 100,000.

References:

1. State and Territorial Injury Prevention Directors Association (STIPDA). *Council of State and Territorial Epidemiologists Injury Indicators for Surveillance*; 1999. (www.stipda.org/resol/99nphss-tbi.htm).
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Data Sources and Method Notes:

Data Sources:

Statewide Deaths: MA Registry of Vital Records and Statistics, MA Department of Public Health; data reported are for calendar years January 1, 1995 – December 31, 2004.

Statewide Acute-care Inpatient Hospitalizations: MA Inpatient Hospital Discharge Database, MA Division of Health Care Finance and Policy; data reported are for fiscal years (FY) October 1, 1995 – September 30, 2004. Deaths occurring during the hospital stay and transfers to another acute care facility were excluded except when calculating charges. All hospitalizations and charges discussed refer to acute care hospitals.

Statewide Outpatient Observation Stays: MA Outpatient Observation Stay Database, MA Division of Health Care Finance and Policy; data reported are for FY October 1, 2003 – September, 30, 2004. Deaths occurring during the visit were excluded except when calculating charges.

Statewide Emergency Department Visits at Acute-care Hospitals: MA Emergency Department Discharge Database, MA Division of Health Care Finance and Policy; data reported are for FY October 1, 2003 – September, 30, 2004. Deaths occurring during the visit were excluded except when calculating charges.

Population Data: Population numbers used to calculate rates include estimates provided by the Massachusetts Institute for Statistics and Economic Research (1995-1998 data), DPH estimates for 1999, 2000 Census file, and estimates provided by the U.S. Census Bureau (2001-2004 data).

Method Notes:

TBI-related cases were ascertained according to case definitions recommended by the Centers for Disease Control and Prevention (CDC) and are based upon International Classification of Disease Version 9 Clinical Modification (ICD-9-CM) codes for morbidity and International Classification of Disease Version 9 (ICD-9, 1995-1998) and Version 10 (ICD-10, 1999-2004) codes for mortality.⁷

Rates: All rates are per 100,000 residents. Rates for age groups are age-specific rates and rates for racial and ethnic groups are age-adjusted. All other rates are crude rates.

Payer Source: Payer source was defined as public if expected payer was specified as Medicaid, Medicare, free care, or other government payer.

Categories and groupings for intent and cause are based on a modified version of the CDC's "Recommended framework of E-code groupings for presenting injury mortality and morbidity data."

Resources for TBI Prevention and Services:

Injury Prevention and Control Program (IPCP)

Massachusetts Department of Public Health
Center for Community Health
Bureau of Family and Community Health
250 Washington Street, 4th Floor
Boston, MA 02108
(617) 624-5413
www.mass.gov/dph/fch/injury/index.htm

Statewide Head Injury Program (SHIP)

Massachusetts Rehabilitation Commission
27 Wormwood Street, Suite 600
Boston, MA 02210
(617) 204-3852 or 1-800-223-2559, ext. 2 (in MA)
TTY: (617) 204-3817
www.mass.gov/mrc/ship

Brain Injury Association of Massachusetts

30 Lyman Street, Suite 10
Westborough, MA 01581
(508) 475-0032
(800) 242-0030 - Brain Injury Info Line
www.biama.org

Occupational Health Surveillance Program (OSHP)

Massachusetts Department of Public Health
Center for Health Information, Statistics, Research, and Evaluation
250 Washington Street, 6th Floor
Boston, MA 02108
(617) 624-5632
www.mass.gov/dph/ohsp

For further information, please contact:

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